

LITURGICAL ARTS

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Editorial

THE current issue of LITURGICAL ARTS is again a departure from our normal form. It is devoted very largely to a thorough discussion of one subject: the use of concrete for ecclesiastical structures. There is perhaps no building material concerning which there has been greater controversy than concrete. It is generally acknowledged that brick and stone are useful, handsome materials, but when concrete is in question, opinions differ greatly. There are those to whom the plasticity of this material seems so important and so full of opportunity for the achievement of forms of which the architects of the past could only dream that they are carried away with enthusiasm, and cannot conceive why the rest of the human race is not filled with the same boundless desire to abandon all of the more old fashioned materials as outworn and cumbersome. Then again there are those who can see no beauty in what they call the "lifelessness" of concrete surfaces. During the last few months this problem has repeatedly been brought to our attention. It is generally known that concrete construction is economical; many of the clergy have been wondering whether concrete did not offer a solution to their building problems. It is in an attempt to make available the best opinion on this subject that we have assembled the articles which follow.

In treating of concrete, we have tried to afford expression to the views of men of divergent tastes and shades of opinion. We have likewise tried to present answers to the fundamental question of the appropriateness of concrete to a church from every point of view of both priest and architect. Mr. Paul Philippe Cret, whose article immediately follows this editorial, is one of the best known of American architects. He himself has used concrete in many structures, and his position as professor of architecture at the University of Pennsylvania has made it necessary for him to keep himself closely informed concerning modern architectural developments all over the world. The fact that Mr. Cret is not a church architect gives him a fresh point of view and a feeling of detachment which a strictly ecclesiastical practitioner might not have. We conclude our treatment of concrete with another brief general discussion by Mr. Frederick Vernon Murphy, head of the School of Architecture at the Catholic University.

To discuss the use of concrete in monumental architecture inevitably leads to the whole question of the "modern" style of design. The engineering of concrete is so fundamentally different from that of brick and stone that one is almost forced into novelties of design if one is to use concrete with honesty. For the traditional styles of church building — byzantine, romanesque, gothic, renaissance — all grew out of systems of engineering imposed by the older masonry of stone-upon-stone or brick-

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upon-brick. The great problem of the Christian church, the spanning of the nave, has always dictated the general arrangement of the ground plan. Stone or brick vaulting required piers and buttresses. Concrete vaulting for the first time makes possible the fireproof spanning of large areas without the necessity of counterbalancing outward thrusts. And in this very fact lies the reason why honest concrete construction almost makes necessary the development of a new style of architecture. Mr. Barry Byrne, an American Catholic architect who has attempted a thorough-going development of a new style in ecclesiastical architecture, gives expression to the philosophy which he feels should underlie any design intended for concrete. His own buildings — the Church of Saint Thomas the Apostle in Chicago, the Pro-Cathedral in Tulsa, the Church of Christ the King in Dublin, Ireland — show that he has carried out his own precepts. Of course, as he himself says, the vitality of any new form of expression must result in violent partisanship, either for or against the new form of art. There are those who disapprove violently of Mr. Byrne's work; and there are those who are his devoted admirers. It is interesting to note that Mr. Murphy, an architect whom no one could possibly describe as "modernist," is in perfect theoretical agreement with Mr. Byrne. Indeed all of the writers who discuss concrete in the present issue are agreed that its use implies profound modifications of traditional design, and it is probably indisputable that for those who desire a purely traditional building, concrete should not be given consideration as a material suitable for major use.

Two of the articles we publish in this issue, Mr. Wood's and Mr. Weed's, are somewhat more technical in nature. Mr. Wood has recently designed and personally supervised the erection of a private residence in concrete which has been considered one of the notable pieces of American concrete design and construction of the last decade. Mr. Wood's personal supervision of this job equips him to discuss the color and texture possibilities of concrete perhaps as well as any one in this country. He has also devoted considerable study to the use of concrete in Europe. Mr. Weed's long experience as concrete engineer has lead him to stress in his article the aspects of the subject which are most likely to lead to bad work. What he says is primarily intended for architects, but it carries one moral for all of us: namely, that it is peculiarly important, if one is to use concrete, to be sure that the contractor doing the work is both thoroughly competent and honest. The unfortunate thing about concrete seems to be that the fruits of careless work do not appear until many months after the building is finished and therefore beyond remedy.

We likewise publish in this issue two interesting modern American concrete structures. One, the Parochial School (Church) of Saint Madeleine Sophie, makes use of concrete as a principal building material, but is most conservative in design. The other, the Church of the Precious Blood in Los Angeles, is fairly typical of the many concrete structures on the West Coast, where the danger of earthquakes makes this a peculiarly suitable material. Two other American examples of concrete church construction appear in the advertising section. It will be noted that all four examples are far more traditional than the German buildings used in illustration of Mr. Wood's article. Indeed we are left, after re-reading the discussions in this issue, with the feeling that perhaps American concrete construction has been a little too traditional. Many of the modern European structures in this medium seem to us ugly and unchurchlike, but the finest of them perhaps have a certain sincerity and dignity which would seem to be the proper goals of all church architecture.

Reinforced Concrete and Ecclesiastical Architecture

PAUL P. CRET

THE development of methods of construction arising from the use of reinforced concrete gave rise to great hopes at the beginning of the present century. Here indeed was an obvious simplification of the problem of enclosing large spaces by other means than inflammable wooden trusses or the stone or brick vault. Yet both of these latter methods of construction had produced fine solutions of this central problem; and to this day they remain for many persons the only legitimate means of procedure.

It has been said that the history of ecclesiastical architecture is the story of a long series of experiments, all attempting to cover a large open space with a minimum of points of support and a height sufficient to assure adequate illumination. It has been the vault which dictated the system of piers and buttresses constituting, in its turn, the plan of the edifice. This vault system, as well as the trusses and curtain walls of stone or brick, are far from having reached the end of their usefulness in architectural history.

Yet the resources of the faithful — often very limited, and imposing the strictest economy — and the natural desire to complete the work as promptly as possible have led our age to seek substitute methods of varying value: vaults in light materials, plaster imitations, etc. Steel, which was tried in France as early as the middle of the nineteenth century, was abandoned, at least as a visible element of construction, because of the difficulty of giving it a satisfactory appearance. For the problem of the church, perhaps more than any other problem in architecture, is not solved by the merely practical solution. The Dutch architect, Wattje, has stated this in the excellent introduction to his work, *Modern Churches*:

A distinction must be made between this expression of efficiency and the representative value of the building as a symbol of that sphere of human life and activity for which it is built. Man has in all ages felt the need of symbols as the signs or representations of the intangible processes of thought and of the different human activities and institutions. Thus it is required of the Palace that it be not merely a fit and comfortable dwelling for a royal family, but that, moreover, and above all, it shall be symbolic of royal dignity. . . .

The edifice, then, has not merely to express suitability and appropriateness, but it must symbolize the end it serves. By the beauty of its outward form it has been through the ages the symbol of the field of thought it is erected to serve, so that it is not merely serving a purpose but also doing honor to it.

Toward the end of the nineteenth century reinforced concrete made its appearance. When one recalls that this material allows spans six hundred feet long in the construction of bridges, one can easily see that to span the modest dimensions of a church nave, in however large a scale it is conceived, has become child's play for the builder. Inexpensive, quick, lending itself to infinite combinations of arches, lintels, and roofs, reinforced concrete seemed to be the final solution to the old problem of spanning the nave. It is thus not at all surprising that the most passionate paeans of joy greeted its appearance. But soon it became necessary to sing another tune.

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The French architect, A. de Baudot, who, as far as I know, was the first (about 1894) to build a church in reinforced concrete, Saint Jean de Montmartre, in Paris, soon discovered the Achilles' heel of the new material. In his book, *L'Architecture: Le Passé, Le Présent*, he tells the story as follows:

When, after many practical difficulties, I had finished the Church of Saint Jean de Montmartre, I was called to the palace of the Archbishop of Paris and received by Monseigneur Richard, who asked me many questions about the use of reinforced concrete, and who seemed to be satisfied with what I told him. Yet he said to me, with perhaps a little malice, "*Monsieur l'architecte*, concrete — even when reinforced — will never replace the stone of our cathedrals." I answered that I was completely of his opinion, but that we no longer lived in the middle ages, when religious faith so valiantly provided the means necessary to erect these monuments. I added that to-day it was necessary to get a great deal for very little, and that, in order to build the churches which the archdiocesan authorities then were planning to construct in Paris, we had to give up any idea of stone, and reconcile ourselves to other materials, of which concrete was the best.

Aware of his lack of aesthetic success, the architect here pleads economic necessity to justify his work. Although he was a theoretician of ability, even if a little doctrinaire, de Baudot did not know how to add to the "expression of efficiency," made possible by the skillful use of a new medium, the symbolic value which makes for beauty.

IT SEEMS that in thirty years we have progressed very slowly in the conquest of forms adapted to the new technique. This is because, despite any belief to the contrary, aesthetic values do not automatically arise from the search for new methods of building. Here are two distinct fields of endeavor, in which the same persons generally do not gather the harvests. While it is true that an architectural style cannot dispense with technical science, still technical progress is only the advance guard which prepares the medium for the work of art.

Is it perhaps due to de Baudot's lack of success that the new medium was not used for some twenty years, and that we have to wait until about 1923 before we find a new attempt to build a church in concrete? It was at this time that the brothers Perret constructed, near Paris, the church at le Raincy, in which they achieved at last a design which is coherent, even though it remains the object of much controversy. There is no need of going over here the controversies to which this church and others designed by the same architects gave rise. Praised by some as the first truly modern expression of religious art, scorned by others who can conceive of no artistic salvation outside the complete acceptance of tradition, this work must be recognized as an achievement, surely still imperfect, but one which marks a definite step in the evolution of religious art. We need only point out how much this work has influenced certain recent structures, such as the Saint Antoninus Church at Basel by Karl Moser (1927), the Stahlkirche in Cologne by D. O. Bartning (1928), and a great number of others.

Side by side with these experiments in a homogeneous structure built entirely of reinforced concrete, whose interior and exterior form is determined by the medium, there has likewise been a considerable use of concrete in conjunction with other materials — stone, or brick, or wood. In this way entirely new vault-forms have been attempted, often with interesting results. And we must note the replacing of inflammable wooden trusses with trusses of reinforced concrete, the use of which is becoming

more and more common. Yet all this has had little effect on the general appearance of the building, and hence is of secondary aesthetic significance.

In the churches which have been built with a frank acceptance of concrete as a surface material, and not merely as a skeleton to be covered with other substances, the most difficult problem is that of unsightliness. We have every reason to believe that reinforced concrete has permanence. Yet it is equally certain that it has a lifeless appearance, that after the passage of a few years tiny cracks appear from which are excreted splotches of salts and soot which have a most unfortunate effect. All the surfacing methods devised up to the present give only temporary results. Sculpture executed in concrete, either by casting or by carving while the concrete is still fresh, soon loses its sharpness of outline, and is not improved — quite the contrary — by the patina of time, as it would be if executed in stone.

Must we conclude from this, as seems to be the case with so many modern methods of procedure which have the twin advantages of quickness and cheapness, that we must always pay for these advantages the price of a "cheap" appearance? Or may we hope that after long experiment we shall be able to learn how to overcome this disadvantage? To answer these questions would be to assume the rôle of prophet, and I hasten to withdraw from the realm of prophecy. This much can safely be said. The use of reinforced concrete in ecclesiastical architecture is a very recent thing. Scarcely ten years have passed since the first resolute effort was made to discover what new mode of expression would suit the new medium. To make a final judgment now, based on these first experiments, however interesting they may be, would be to forget that ten years is an inconsequential period of time in the history of architecture, which has always measured its changes in terms of generations.

A Philosophy of Design for Concrete

BARRY BYRNE

THE INTEREST to be found in any contemporary manifestation in the arts has its basis in a reasonableness more profound than what is evidenced by mere vogue or mode. It is to be found in that response, or reaction, which arises from closeness to the scene of life when the art, be it good or bad, is sufficiently of ourselves to excite us either to enthusiasm or derision. A reaction against such artistic manifestations, when these are valid and of a high order, is in itself indicative of a living quality in them. That our preconceived ideas of suitability are affronted and that that too comfortable and somnolent mental condition which is so often ours is jarred indicate worthiness rather than the reverse. The quality of *life* is of the essential soul of an art work; without it art cannot exist as a reality. Art is positive in its character and demands acceptance, or complete rejection. This is far removed from the commonly accepted ideas arising from the art of escape — that negation of life which cushions the sensibilities and offers to the less mentally courageous the refuge of sentimentalized falsities.

Such a characterization as the preceding applies equally to aesthetic reaction to all of the arts generally, and particularly concerns architecture, which is the most traditional and rigid of all. Architecture accommodates itself with difficult and slow-moving progress to the changes life indicates as necessary. The lack of response of architecture to the mechanical and engineering development of the last century confirms this statement. In this period we find a complete lack of accord between the development of the practical sciences and the development of architecture, which should be closely related to and dependent on them. The fact of the continued existence of a traditional and obviously inappropriate architecture, integrated with a rapidly progressing engineering and mechanical science, has been one of the anomalies of current existence. That this anomalous condition has persisted until now is evidence of the fact that architecture responds slowly, even if inevitably, to the coercive facts of existence. That this response is inevitable is now indicated by the overwhelming change in the point of view of architects and in their almost universal efforts to achieve more appropriate forms in design. Architecture is again taking on the semblance of life, and if its manifestations in form are too often distressingly coltish and immature, it is only what must be expected, in this recurring youth of a great art.

The forms of this current, developing architecture exhibit evidence of the coercive effect of mechanical and engineering conditions. There are occasional results that savor of achievement to the degree that the architectural forms reveal their identity with the related engineering and mechanical sciences. Also there are occasional examples of a further response, in forms, to the influence of structural materials: metal, brick, stone, glass, and concrete. The last named, which is in the category of masonry materials, is that most closely identified with modern developments in engineering science. Because of this, concrete is the building material that is the most challenging to an architectural mind which is preoccupied with the age-old problem of the form which shall reveal the underlying structure of the building. This was the essence of Gothic — a stone style whose forms revealed the engineering content of the stone structure. We seem about to return to such an engineering architecture, the aesthetic

of which will partake of the natural vitality inherent in those elements that support and span a building. In the case of concrete, the logical process will not only result in forms that dramatically and beautifully reveal the engineering, structural essence of the building, but will also reveal the concrete itself in such beauty of form and finish as the nature of the material requires.

Concrete has unusual possibilities for the production of an architecture which will be pure in type and in which the indicated structural elements, those of support and span, may constitute the basis for imaginative design, as suggested by the building plan itself. This envisages an architecture in which the true component elements, appearance and reason, may again have existence, as they once existed in mediaeval architecture, thus making it a source of intellectual as well as sensory satisfaction. It is in this merging of elements that appearance is raised from the plane of an arranged tastefulness to that of significant and abiding beauty. It is the result of an aesthetic essentially subjective in its character, having its basis in the acceptance of physical realities, but realities transmuted by an infused, imaginative content.

The architectural approach in design in a masonry material, which may be stone, brick, or concrete, requires the development of forms with special reference to the nature of each material. To execute in concrete forms originating in stone is to deny the nature of the concrete, and the artistic result can only be disastrous. The design *idea* for a concrete, architectural structure originates in the building plan and accepts, as a primary and determining fact, the constituent material. Design should then be entirely concrete, rather than an adaptation of this dignified material to inappropriate stone architectural forms and arrangements. This latter, inappropriate method has been the usual one, and the result has had neither the fine quality of cut-stone masonry, nor the slender, vibrant, clean quality of cast concrete. The artistic outcome has been that which might reasonably be expected when the problem has not been truthfully faced and solved; and any possible aesthetic unity has been impaired by a lack of artistic direction.

A monumental architecture, such as is suitable for church design, entails not only unity of form, but also essentially monumental and permanent materials and construction. Unity of materials and construction is one of the sources of that satisfaction to the spirit which is so completely felt in the authentic, living Gothic work of the middle ages. Concrete offers again the possibility of this unity of material for a monumental architecture, no longer restricted by the narrow limits of the Gothic plan, but adaptable to modern space arrangements and to great vaulted spans. Its possibilities of added enrichment by the use of sympathetically related materials, glass and metal, suggest a growing beauty for a type of structure, sound in its aesthetic essence, which may in time, and with available funds, be brought to an increased glory, by the sensitive accretion of related decoration. Mosaic, glass in its cast and sheet forms, frescoes, metal in its profusion of existent forms indicate the possibilities of beauties which time may add — without haste, and with the feeling that successive generations of life are adding their measure to the total of an ever growing loveliness.

The Parochial School of Saint Madeleine Sophie

Germantown, Pennsylvania

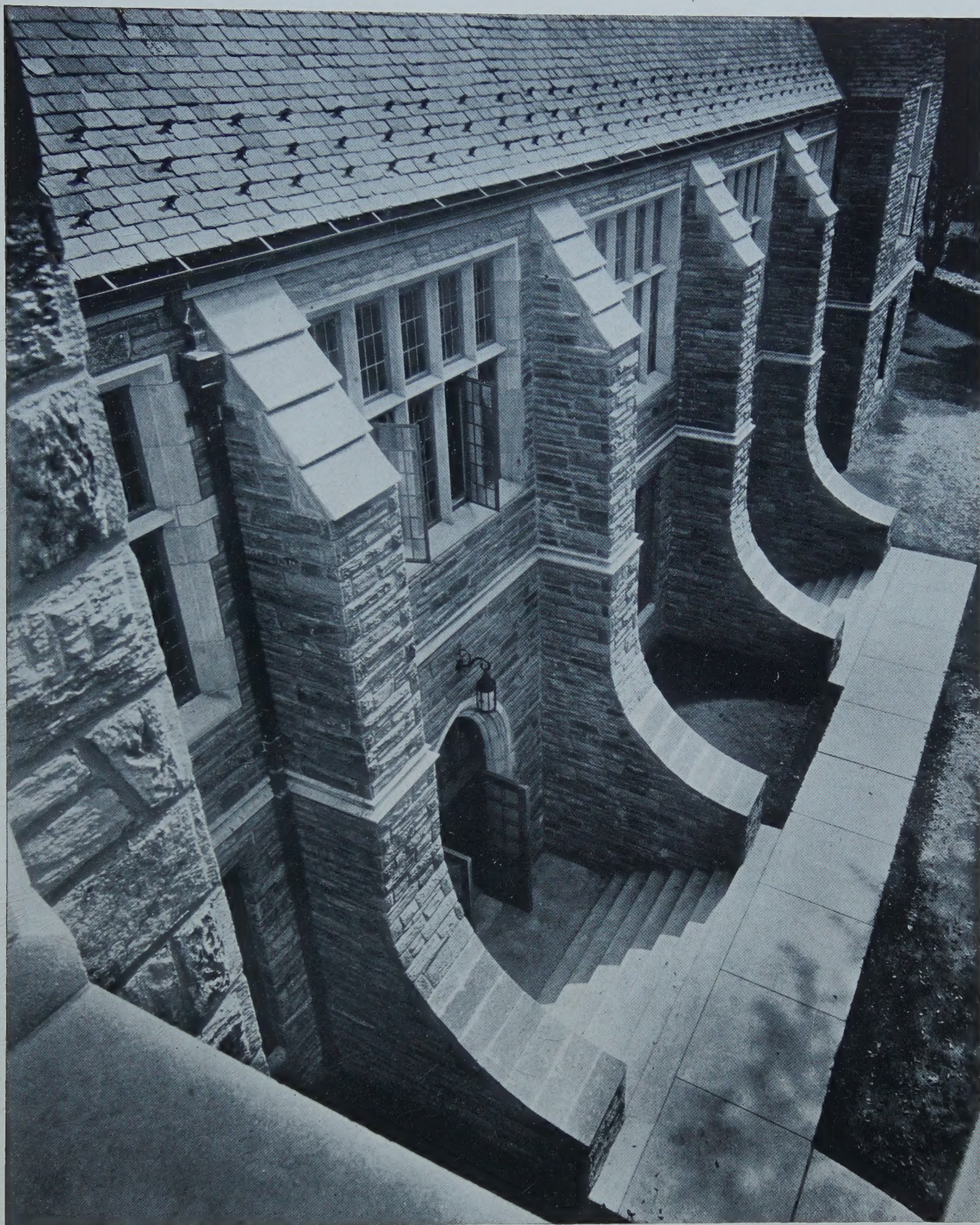
THE principal architectural problem involved in this building was a plot very far from level and with considerable differences in grade along the street which the building had to front. It had been determined by the parochial authorities that the school building should be erected first, to be followed by the church when funds became available. Thus an auditorium was required which would be large enough to serve as a church for some years to come. Indeed the auditorium as constructed represents a far more refined conception than is usual in such structures, and serves admirably the purpose for which it is now used and will be used until the church proper is built. The school accommodates about four hundred and fifty children; the auditorium used as a church seats six hundred and fifty persons.

It was determined to use concrete as a principal building material, particularly for the auditorium, but to face the exterior with natural stone. Slate was selected as a roofing material. The result was a building so highly fireproof that its insurance rating is the lowest possible in the city of Philadelphia, a very real factor for economy in later years. It is not the purpose to deal here with the school facilities of the building, the general arrangement of which is shown in the ground plan (page 59). Several of the photographs reproduced herewith (pages 57, 58, and 63) show the exterior treatment of the school sections of the building. The most interesting part of the structure from the point of view of concrete is the auditorium.

Entrance is gained from the street up flights of stairs which are required by the higher level of the ground where the auditorium is situated. Access to the auditorium (church) is likewise possible through side doors (see photographs). At the rear is a small choir loft with a simple balustrade of wood. This loft is really in the shape of a large niche, rather than the usual overhanging gallery, an arrangement which avoids the crowded feeling usually produced at the rear of a church which has a projecting loft. The confessionals are likewise at the back. The wood pews are of very simple design. The monolithic construction of the vault, possible only in concrete, removes the necessity of interior piers, while the monolithic ribs of the vault are carried to the ground through very simple buttress-like piers, which reappear on the outside of the building.

Purlins, likewise of monolithic concrete, run from rib to rib. These are polychromed in simple geometrical patterns. The sanctuary is framed by a monolithic arch which carries out the general design of the arch-like ribs of the vaulting. It is perhaps a question whether a more valid effect might not have been obtained by omitting the v-shaped grooves in the concrete, which give an unfortunate impression of an attempt to imitate stone masonry.

The altar, of marble with marble inlays, is intended as a permanent installation which will be removed to the projected church when it is built. It is surmounted by a simple carved wooden reredos in which is incorporated a very handsome all-seasonal dossal designed and executed by the Talbot Studios. The tabernacle, reproduced elsewhere in this issue, is of bronze and monel repoussé work. It, as well as the candlesticks, lighting fixtures, and sanctuary lamp, is the work of the Iron-



A SIDE WALL OF THE AUDITORIUM (CHURCH) OF SAINT MADELEINE SOPHIE, GERMANTOWN, PENNSYLVANIA. THE CONSTRUCTION IS OF CONCRETE, FACED WITH NATURAL STONE (HENRY D. DAGIT & SONS, ARCHITECTS)

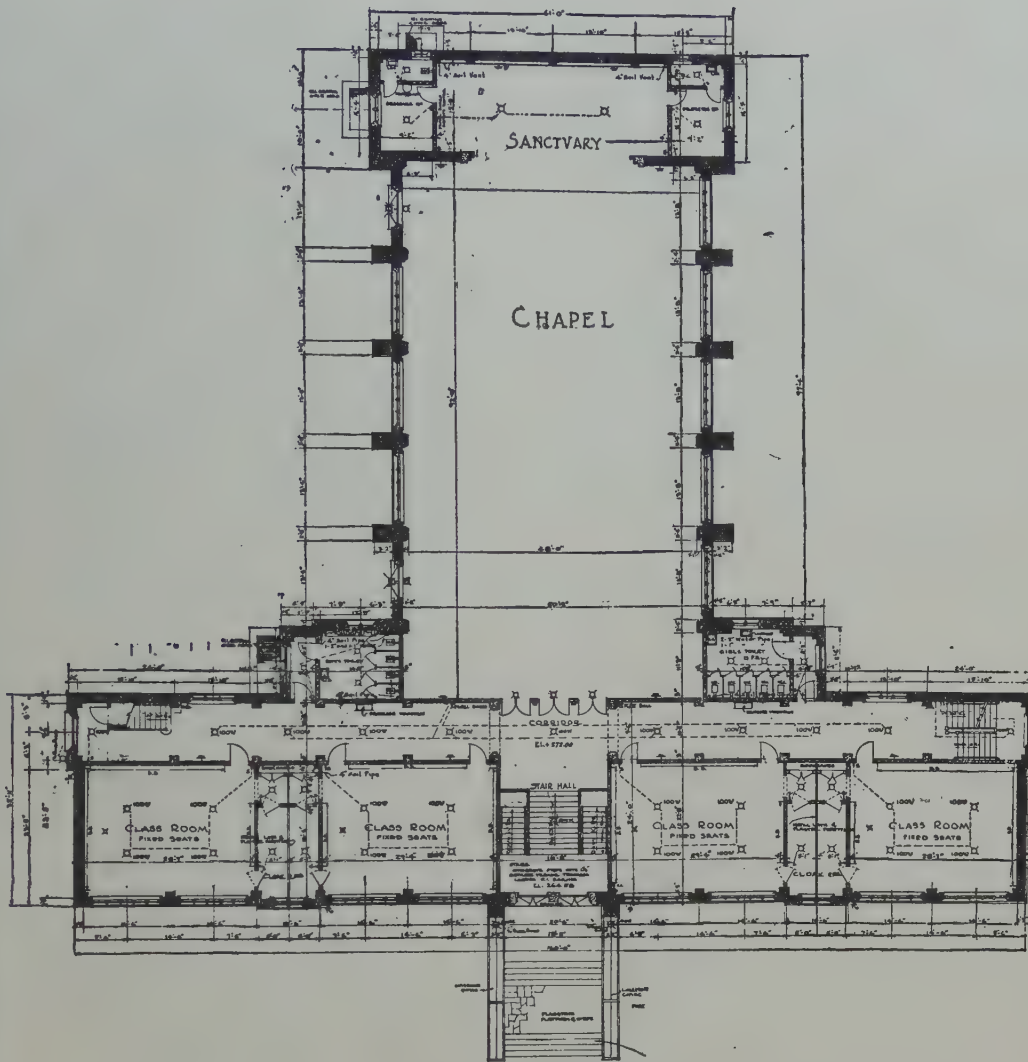
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TWO INTERIOR DETAILS OF THE CHURCH OF SAINT MADELEINE SOPHIE SHOWING THE MONOLITHIC CONCRETE ARCHES AND VAULTING. THE POLYCHROMING OF THE PURLINS IS MORE PRONOUNCED IN THE PHOTOGRAPHS THAN IN REALITY



SIDE VIEW OF THE CHURCH OF SAINT MADELEINE SOPHIE. THE SCHOOL WINGS ARE TO THE RIGHT OF WHAT MAY BE SEEN IN THE PHOTOGRAPH



FIRST FLOOR PLAN

PARISH SCHOOL AND CHAPEL
of
ST. MADELEINE SOPHIE
GERMANTOWN, PA.

HENRY D. DAGIT & SONS
ARCHITECTS.

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Craftsmen. It is perhaps worthy of comment that the bracketed wood canopy over the main altar may be criticized from the point of view of liturgical correctness, since it by no means covers the celebrant and therefore does not serve the purpose for which the canopy is intended. The aesthetic effect, however, is handsome, dignified, and harmonious.

Indeed the general interior of the Church of Saint Madeleine Sophie emphasizes one quality of concrete construction: the cleanness of line and design which the plasticity of this material makes possible. There is a certain elegant simplicity in the conception of the structure which gives some faint indication, at least, of the direction in which concrete design must go.

The question of price is of very real importance in considering any concrete structure, for one of the most boasted merits of this material is its economy. Of course in the case of Saint Madeleine Sophie's, the stone exterior facing added to the cost, an addition which many would consider amply justified in better appearance. It is likewise true that this building is not a new one: the contracts were let at the peak of 1929 prices. To-day it would be possible to do the work for far less. It therefore does not seem just to state the actual cost of the work. It may safely be said, to give some indication of the amount involved, that such a building could be erected at present prices for about \$150,000. This is surely a reasonable cost for a plant with so considerable a capacity as that of the school and auditorium of Saint Madeleine Sophie. (Henry D. Dagit & Sons, Architects.)

The Church of the Precious Blood

Los Angeles, California

THE lot on which it was planned to construct the Church of the Precious Blood was approximately triangular in shape, as will be seen by examining the ground plan (page 62) and therefore peculiarly suited to a cruciform design, with the rectory placed at the rear of the church. Unfortunately the nature of the ground on the site was such that unusual expenditure had to be made on the foundations. Concrete piles twenty-seven feet long were necessary for the adequate support of a masonry building. These piles alone added some ten thousand dollars to the cost of the edifice. Because of the constant danger of earthquakes in Southern California, ferro-concrete has long been a favorite structural material in that part of the country. It is a medium not entirely earthquake-proof (probably no material is that), but it resists the action of earthquakes perhaps as effectively as anything known. This is particularly true when a reinforced concrete building is especially designed with this factor in mind. The engineering work of the Church of the Precious Blood was entirely under the supervision of Mr. C. J. Derrick of Los Angeles, who has worked with the architects of this structure, Messrs Henry Carlton Newton and Robert Dennis Murray, on all of their church buildings.

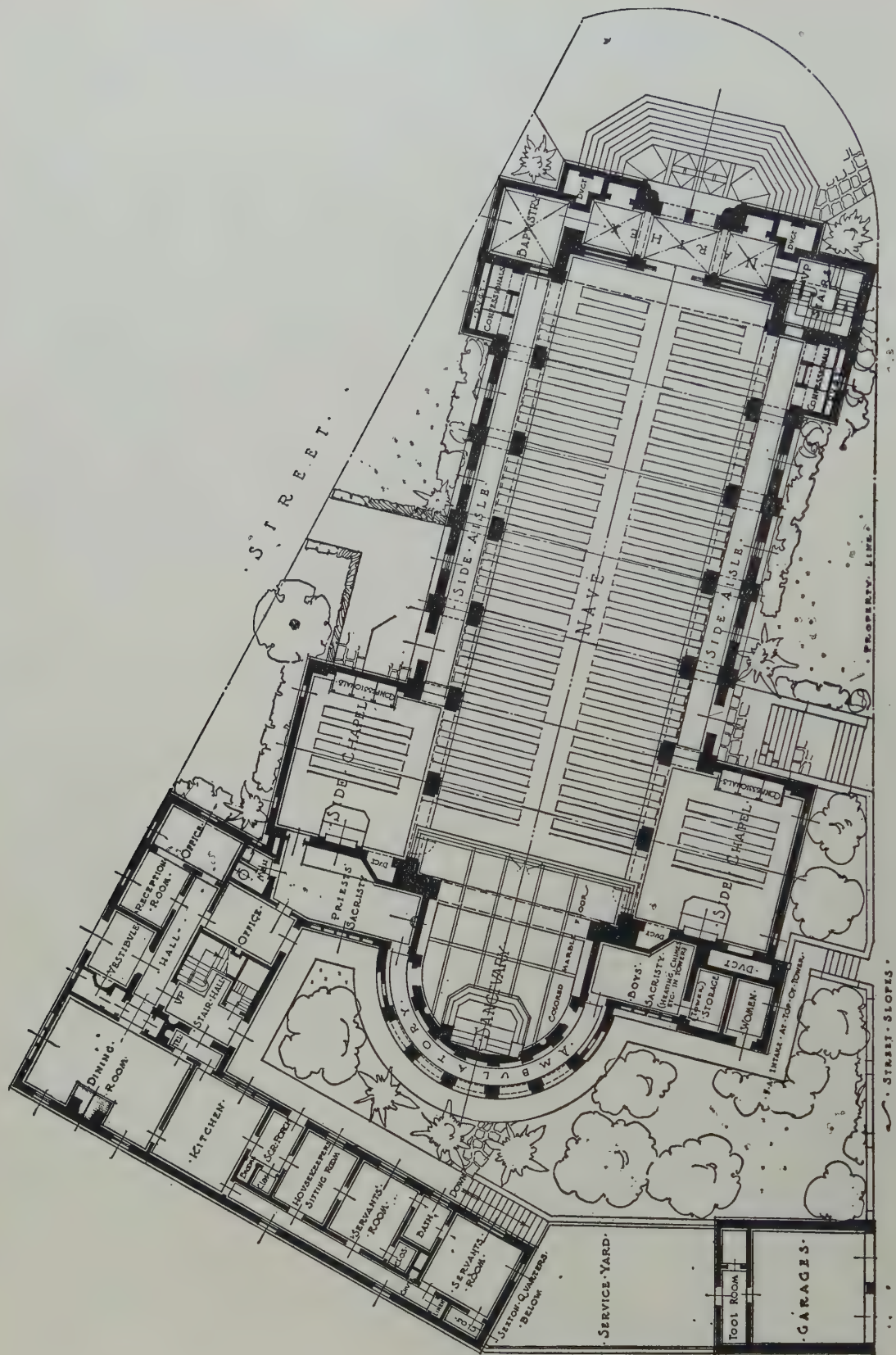
The Church of the Precious Blood seats seven hundred and fifty people. The nave is approximately ninety-six feet long and fifty-two feet high. When we learn that this building involved a total expenditure of about \$130,000.00, we can appreciate that concrete is indeed an economical medium.

It will be noticed from the photographs (pages 64-6) that the entire church is of monolithic construction, although the walls are in part hollow to lighten the load on the foundations. Most of the ornament, which is of a modified order of romanesque, was cast in place. There are those who, perhaps, would prefer an even less traditional style of decoration for a concrete structure; but the architects in this instance seem to have found a far happier solution of the problem of reconciling a traditional style to reinforced concrete design than is usually the case.

One enters the church through a handsomely carved portal of tufa stone, a volcanic material which hardens when exposed to the elements. Perhaps one of the most interesting decorative elements in the building is the figure of Christ carved on the *trumeau* of this portal. In the words of the architects: "The desire was to obtain a representation of yesterday, to-day, and to-morrow. It is a beautiful combination of ancient carving with a suggestion of Chartres and of modern work. . . . There is a strange similarity between some of the very archaic Greek carvings, some of the figures on the portals of Chartres Cathedral, and certain modern work. It is perhaps the high degree of simplicity which has been maintained in them — the true expression of an ideal without a slavish copying of the human figure, the admission that the human figure cannot be exactly copied in stone, but must be merely represented or indicated. S. C. Scarpitta was the sculptor."

The interior of the church, as shown in the accompanying plates, is yet incomplete. The stations of the cross, notably, are temporary. One of the most unusual features is the series of corbels, each representing in symbolism one of the sacraments, which

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STREET
HENRY CARLTON NEWTON AND ROBERT DENNIS MURRAY
ARCHITECTS



THE SANCTUARY OF THE CHURCH OF SAINT MADELEINE SOPHIE. THE

ARCH IS OF MONOLITHIC CONCRETE; THE ALTAR IS RICHLY INLAID MARBLE



DETAILS OF THE ALTAR AND REREDOS OF THE CHURCH OF SAINT MADELEINE SOPHIE. A SPECIALLY EXECUTED SILK DOSSAL AND TESTER IS PLACED IN THE CARVED WOODEN FRAME WHICH FORMS THE REREDOS





GENERAL EXTERIOR VIEW OF THE CHURCH OF THE PRECIOUS BLOOD, LOS ANGELES, CALIFORNIA (HENRY CARLTON NEWTON
AND ROBERT DENNIS MURRAY, ARCHITECTS)



GENERAL INTERIOR VIEW OF THE CHURCH OF THE PRECIOUS BLOOD. THE ENTIRE BUILDING IS OF REINFORCED CONCRETE, THE FORM MARKS BEING LEFT PLAINLY VISIBLE. THE ROOD BEAM IS OF SOLID NATIVE REDWOOD

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THE TOWER OF THE CHURCH OF THE
PRECIOUS BLOOD WHICH HOUSES THE
CHIMES AND A VENTILATION SYSTEM



THE ENTRANCE PORTAL OF TUFÀ STONE.
THE TYMPANUM IS OF MOSAIC AND REPRESENTS
OUR LORD WELCOMING THE LITTLE
CHILDREN. THE TRUMEAU IS ADORNED WITH
A FIGURE OF CHRIST BY S. C. SCARPITTA

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contain on their upper surfaces small light sources designed to cast an indirect, dim glow over the stations of the cross to be installed above them. These stations are at present being executed in glass and marble mosaic. The spandrels above the arches on both sides are to be decorated in the same medium. The trusses are of steel, with ornamental coverings of heavy redwood members; the exposed roof sheathing is of random width, v-joint redwood boarding. The rood beam is of a single piece of redwood, fourteen by twenty inches in section. It will be noted that there has been a happy use of native materials throughout this structure, particularly in the redwood and tufa stone. Most of the craftsmanship of the building is likewise local. And the Pastor, the Reverend Michael O'Halloran, is to be most heartily congratulated on having left a good many opportunities for future adornment, both inside and out.

One of the interesting mechanical features of this church is that it contains a system of forced ventilation for which the equipment is housed in the tower, which likewise houses the chimes. The fresh air intake is well above the ground. There is little reason why a congregation during the summer months should be forced to suffer unduly from the heat; and in a poorly ventilated church this easily remediable condition inevitably leads to a serious if necessary curtailment of the liturgy during the summer months. Surely here is one facility offered by modern engineering which is well within the means of most parishes and which could help to make the summer months less of a liturgical "off-season" than they now so usually are.

Ferro-Concrete as a Building Material

JOHN WALTER WOOD

FERRO-CONCRETE is a plastic medium formed of a synthesis of materials which fuse by chemical action into a rocklike mass, capable of longer spans than masonry; and while being more fire resistant than steel, concrete has a permanence comparable to that of stone. Ferro-concrete may form both frame and garment of the structure; and the color, forming an integral part of the anatomy of the building, may be practically any hue desired. It is for such reasons of architectural design as well as for economic reasons that ferro-concrete is being used more each year.

Concrete is an old and proven material. It was used by the Romans in the erection of many famous buildings, notably the Pantheon, whose concrete dome of one hundred and forty foot span was built in A.D. 120. Yet it was not until the middle of the nineteenth century that steel was first inserted in concrete, thus forming what was virtually a new material — “reinforced” or “ferro-concrete” — the steel rods being used to take the tensile stresses (as do the muscles and tendons of the human body). This permitted an architecture of slender supports and long span in contrast to the thick walls and massive piers into which the Romans poured their concrete and resulted in a saving of material and labor and in a simplification of architectural design. It should be noted that the reinforcing steel is made up of rods varying in thickness according to need, but being rarely greater than one and one-fourth inches in diameter.

As comparatively few people have had an opportunity to see the best examples of the concrete work of to-day, it is natural that our conception of concrete should be confined largely to the industrial uses to which it has been put; and while it is common knowledge that concrete is highly useful, its possibilities as an outstandingly beautiful material have been overlooked in spite of the fact that its use in the construction of stadiums, residences, concert halls, churches, etc., has been increasing. An outstanding example of the wearing and weathering qualities of concrete is the Harvard Stadium, built in 1901. Practically no money has had to be spent on the upkeep of this structure (Plates 16, 17). Another notable example of modern concrete work is the twin dirigible hangars built at Orly, France, in 1923 (Plate 15). Concrete churches have been built in California and in South Germany, Switzerland, France, and Hungary. But before describing its structural characteristics and decorative possibilities, I should like to discuss briefly the nature of concrete and concrete work for those who have not had the opportunity of studying a concrete building in process of construction.

The hardening of concrete is an entirely different process from, let us say, that of the sun-baked mud walls of the adobe houses of the American Indians of the Southwest. This latter hardening is merely a drying out of the materials used without any corresponding change of chemical structure; whereas in concrete the hardening arises from a chemical process known as the hydration of the cement, a process which changes the very nature of the materials involved and causes them to solidify into a rocklike mass.

The ingredients of concrete are cement, water, and various inert materials. These latter are called the “fine” and the “coarse” aggregate of the concrete mixture and

usually consist of sand and broken stone. These simple materials form the principal elements of a medium of unsurpassed architectural possibilities. Concrete possesses many unique contrasting qualities. As a plastic medium it may readily be molded into any form, thus surmounting the usual limitations of masonry (the placing of unit upon unit); yet when once concrete has solidified, it possesses a rigidity, a permanence, and a unity surpassing that of any other building material. Concrete has a wide range of surfaces, from smooth, or polished, to extremely rough (Plates 10-13). A concrete wall may have the serenity of smooth, jointless surfaces, the interesting play of light and shadow of a rough-grained surface, or the restless intricacy of all-over patterns molded into the fabric of the structure. And while the color of common cement is a monotonous gray suitable only for foundation walls and for covered piers and floor slabs, exposed concrete wall surfaces may be made bright with color. Contrary to popular belief, which associates the color of concrete with the lifelessness of most industrial work, there is a color range and a control of color in concrete work not possible in any other building material. Structures may be built glowing with a color limited in beauty only by the skill of the architect.

To utilize concrete's unique character and beauty it should not be used in imitation of stone or of any other material. Unfortunately pre-cast concrete structural units have sometimes been called "artificial stone," thereby encouraging the imitation of natural stone, which, beside putting the material to a false use, is entirely unnecessary, since concrete not only has structural advantages possessed by no other building material, but also can become a material of fine color and surface texture when properly handled and frankly used. It is thus unsuitable to use poured concrete in Romanesque or Gothic designs, or in adaptations of other historic styles; for these were all essentially hand-made architectures, built by skilled craftsmen and bearing the impress of the men who made them. Such a use of concrete, no matter how beautiful the original forms which serve as inspiration, can only give a lifeless result, reflecting little credit on the Church and bearing no relation to the life of our time.

Since we are neither economically nor artistically fitted to reproduce the architectural styles of the past, we are bound to make use of modern materials and modern building methods, whether these be steel, brick, stone, or concrete, in the creation of a church architecture of to-day which will have lasting beauty and permanence because it is built sincerely with materials and building methods we understand. This church architecture of our own time is to be achieved by approaching the problem with directness and simplicity and by drawing our inspiration from the Church of to-day, which is still "living and acting with all the energy and vigor of youth — the full fulfilment of her Divine Founder's promise." *

Fine proportioning of the main and secondary building masses with a just relation of space volumes and their encompassing planes and a harmony between these elements and with the liturgical and practical requirements of the Church constantly to the fore will result in an architecture over whose wall surfaces the play of light will form a fitting setting for the celebration of Mass; which, as all Catholics know, is not a lifeless survival of the past, but a vital and living spiritual force. For two thousand years the Church has availed herself of the temporal methods of the day to accomplish her divine mission. Catholic church architecture has molded and been molded by the building methods and materials of the day; spiritualizing and beautifying these

*His Eminence John Cardinal Bonzano, Papal Legate at the Eucharistic Congress, Chicago, 1926.

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“modern” elements, the Church has infused them with new life and dignity and made them her own. In this same way members of the Church have always made use of the latest inventions. Thus Sainte Thérèse used the railroad on her pilgrimage from Lisieux to Rome, and to-day the Holy Father uses the radio, and missionaries use the airplane. The traditions of the Church are best realized by serving her by means of the inventions, materials, and methods of one’s own time.

The following quotation from *The New World Architecture* by Sheldon Cheney applies strikingly to ferro-concrete architecture: “Frame and garment are one. What determines the character of a building is thus not the ornament, but rather the massing, the proportioning, the use of materials according to their virtues, and a certain rhythmic play over all these things.”

With liturgical requirements and tradition as our guide, the living spirit of the Church must be expressed in materials and forms of our own time, for only in this way is it possible to continue the great building tradition of the Church, and only thus will a vigorous architecture be achieved fit for the celebration of the Mass.

In the paragraphs which follow, I shall try to describe how some of the decorative possibilities of concrete may be achieved.

1. THOROUGH KNOWLEDGE NECESSARY. Successful work in concrete depends upon a thorough knowledge of the character of the material, which includes particularly the proportioning of the concrete mix, with special reference to the amount of water used, and the proper methods of placing in the forms and curing (i.e., care of the concrete while hardening). By merely keeping concrete damp for the first ten days after pouring, it will be about seventy-five per cent stronger than if allowed to dry out. Poor concrete is rarely the fault of the cement, whose production by reputable companies has resulted in a highly standardized product. Poor concrete is usually the result of its use by those who do not fully understand the nature of the material, as may indeed often be proved by examining poor concrete work which has cracked, flaked, or disintegrated.

A building properly designed for concrete construction, with the proper concrete specifications and arrangement of steel reinforcement, may be built with unskilled labor, provided the building superintendent or foreman has a thorough understanding of concrete. Here is a material highly suited to the building methods of to-day, no knowledge of a specialized nature being required of the workmen provided they work under a supervision skilled in the most advanced use of concrete and work from the proper kind of working drawings and specifications. As the ingredients of which concrete is made are easily transportable in small bulk, and the only machinery required is a concrete mixer, a concrete building may readily be built in any locality.

2. CONTRACTION AND EXPANSION. Proper building design, with the proper concrete mix, placing in forms, and curing of the setting concrete will eliminate any danger of cracks appearing in the structure. Such cracks result from the initial shrinkage of the concrete when still in a somewhat plastic state and from the contraction and expansion of large building masses. Steps must be taken to meet this tendency by the use of proper methods in pouring, temperature reinforcement, and adequate expansion joints. These joints may be made absolutely watertight, and it is frequently possible to design the building so they will not be visible.

3. **TYPES OF CONCRETE WORK.** There are two main divisions under which concrete work may be classified: "poured" concrete and "pre-cast" concrete; or a combination of both may be used in the same building. A poured concrete building, sometimes referred to as a monolithic structure, is one in which the concrete is placed directly into molds, which serve to confine the plastic concrete until, after the hydration of the cement has taken place, it turns directly into vertical and horizontal supports of the structure (Plate 14). A pre-cast building (Plate 1) is made up of units which have already hardened, and which have been cast in separate molds either at the job or elsewhere. These units are then set in place with mortar to form walls of concrete masonry. There are several other methods used in concrete work which belong outside the above broad classification, among which may be mentioned the system of permanent centring used by Professor Dom Bohm in the Kriegergedächtnis Church at Neu-Ulm, Germany. In this method the main reinforcing rods are securely fastened to temporary wooden joists by wires. The remaining reinforcing rods are in turn attached to the main bars. A mesh of small burnt-clay elements united by wire is tied to the reinforcing network and a thin layer of special light concrete is applied on top of the mesh. Two or three days later ordinary concrete is tamped from above to the required thickness, and the mesh is plastered with cement mortar from below. After the concrete has set, the supporting wires are cut and the joists removed. By similar methods domes of great span, lightness, and strength have been built.

4. **PLASTICITY.** Because of its perfect adaptability to compression and tension, the strength of a concrete member of fixed dimensions may be varied by merely increasing or decreasing the sectional steel area. This permits far longer spans than are possible in any form of masonry construction (Plates 4, 5), and permits the use of cantilevers (projecting or overhanging members) which are a logical development of concrete's monolithic character. They greatly increase third-dimensional possibilities and result in a greater freedom and in a simplification of architectural design.

5. **PERMANENCE AND DENSITY.** In addition to a lower initial cost than first-class masonry construction, the upkeep of good concrete work is negligible, and is certainly lower than for any other building material, no repainting, repointing, or replacement being necessary. The fireproof qualities of concrete make possible a saving on fire insurance, besides diminishing the danger of loss by fire, which is a constant threat to a non-fireproof structure. Concrete is waterproof, it having even been used in the construction of water tanks and for the hulls of boats. Anyone who has attempted to make an impression on good concrete with cold chisel and hammer will testify as to its density and wearing qualities!

6. **COLOR POSSIBILITIES.** Color is one of the most important elements in architecture, and its right use is a forcible yet subtle way of obtaining an effect by simple means. The right use of color will bring out the fine qualities of the simplest structure in a way not possible by any other means, just as its wrong use will tend to neutralize the effectiveness of an otherwise fine building. The soundest use of color in concrete is that which makes it an integral part of the structure, this being done by the employing of mineral pigments, which are thoroughly mixed with the cement before being combined with the aggregate and water. The final color can only be determined after the mixing of trial batches of concrete in which the different elements are varied, the concrete in each batch being allowed to set or harden for a week to ten days, because the final color is quite different from that of the newly mixed concrete. Relatively

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strong non-fading colors are available, although it is usually found more advisable to use intermediate shades. Color of the highest intensity may be secured by using pigment in combination with white cement. Highly satisfactory results have been obtained by using pigments with a combination of half white and half common gray cement. Practically any color desired may be obtained by the mixing of pigments of various reds, yellows, and blues.

7. MIXING OF CEMENT AND PIGMENT. The pigment and cement should be mixed dry in order to obtain a uniform concrete surface color. A simple method of mixing the pigment and cement is to feed the required amount of each into a small hand mixer, which is geared to the mechanical mixer by means of a belt; the thoroughly mixed pigment and cement can then be fed through a pipe into the mechanical mixer in which the aggregate and water are ready for mixing. (Plate 9)

8. APPLIED SURFACE TREATMENTS. On account of the monolithic character of poured concrete, it forms an admirable surface for the application of stains and paints, which may be applied by brush directly to the concrete surface after the concrete has thoroughly cured. This use of color has been frequently used for exposed ceiling beams and girders. A notable example is the vast Mess Hall at West Point. Or a whole concrete wall surface may be glazed by spraying on the color with a compressed air spray, thus producing jointless, washable surfaces in any desired color. Plaster or mozaic may be applied directly to concrete which has been roughened before it has set in order to provide a surface to which the plaster or mozaic may be bonded. These are the principal applied surface treatments used to obtain any desired color and texture for interior work.

9. CONCRETE SURFACES. Roughly speaking direct concrete surfaces are of two kinds, those in which the cement paste forms the exterior surface and those in which the cement-paste surface has been removed to expose the aggregate. On a concrete surface from which the forms have been stripped there will normally be found a film of cement paste, varying in thickness from approximately one-eighth inch to one-thirty-second inch, which covers the aggregate but through which some of it may appear on the surface. Let us first consider this type of surface.

10. SMOOTH SURFACES. To obtain a perfectly smooth surface, the forms should be stripped from the concrete while it is still green, that is before it has had time to harden, in order that any ridges which may have formed may easily be removed and any necessary patching attended to before the concrete has completely hardened. Once the concrete has thoroughly set, so that pieces of the aggregate cannot become loosened, the wall may be gone over by hand with carborundum bricks or with electrically operated revolving carborundum discs. (Grinding mechanisms exist which are light enough to be carried and operated by one man.) This treatment will result in an absolutely smooth wall surface, although the form marks will usually be faintly visible. (Plate 11).

Another method to secure a smooth wall surface, and one in which the form joints will *not* show, is to prevent the forms from marking the concrete surface by placing sheets of various smooth materials, such as metal, plywood, or wood composition, between the forms and the setting concrete.

A moderately rough surface of pleasing texture may be obtained by making use of the form marks as part of the wall texture, as was done on the Church of the Precious Blood reviewed in this issue.

But when it is expected that the form marks will be visible in poured concrete work, it is important that the forms be built to make a pleasing pattern which will add interest to the wall surface. Somewhat rougher textures can be made by an all-over scoring of the surface while the concrete is still green, the resulting appearance of the surface depending upon the skill and care exerted. A most successful uniform surface was secured in this manner on a poured-concrete church at Budapest, this process wholly eliminating the form marks. In this case, for the non-bearing exterior walls, lime was added to the mix up to fifty per cent of the amount of the cement, and the coarse aggregate was a soft tufa stone, the cantilevered roof being carried on interior piers.

11. ROUGH SURFACES. The second general type of wall surface is that in which the coarse aggregate of the concrete is exposed by the removal of the cement paste film, this necessarily resulting in a coarse textured surface and in the total elimination of the form marks. In this type of wall surface the selection of the coarse aggregate will determine the roughness of the wall texture as well as being a determining element in the final color obtained. To obtain this type of wall surface, the forms are stripped while the concrete is still green, the cement paste being removed with a stiff wire brush to expose the coarse aggregate. The removal of the cement paste is made easier by coating the inside of the forms with a special preparation which retards the setting of the exterior cement paste for thirty-six hours, thereby greatly simplifying its removal. To obtain a uniform texture by this method, the concrete should be carefully tamped and spaded against the exterior forms at the time of pouring. In an exposed aggregate wall, the color of the wall surface as well as its texture will principally depend upon the color, size, and grading of the aggregate selected; and the uniformity of the texture obtained will depend upon methods used in mixing and in the placing of the still plastic concrete. (Plate 12)

12. DECORATIVE MOLDED ELEMENTS. On account of its plasticity when placed in the forms, concrete lends itself to many interesting decorative treatments. Simple or highly complex decorative elements may be cast as integral parts of the building by placing reverse molds modeled in plaster in the wall forms. These designs may thus be cast with the concrete wall and become an integral part of the monolithic structure. Flat relief sculpture, or panels of pre-cast concrete, stone, marble, colored tile, or other materials may be set flush in the walls by fastening these in the forms and tamping the plastic concrete around them, the initial shrinkage of the setting concrete being sufficient to incorporate these elements in the wall. Open grilles may be made of pre-cast concrete at low cost and set in wall openings, or used as balustrades; or simple designs may be cast into the wall by nailing wood strips inside the forms, tamping the concrete around them, and removing them once the concrete has set (Plate 11; see also Plates 6, 7, and 10-13).

13. CARVING IN GREEN CONCRETE: An interesting use of poured concrete has recently been developed in which the sculptor works directly in the green and newly poured concrete. This was the method used by the sculptor M. Sarrebezolles for the Church of Saint Louis Villemomble, France, the figures being twenty-one feet in height and forming an integral part of the structure. The wooden forms were built up to block out the figures and the finished work was chiselled out by the sculptor before the concrete had set. The concrete mix which was used for the figures was the same as that for the tower of which they form a part, except that the coarse aggregate was omitted (Plate 3).



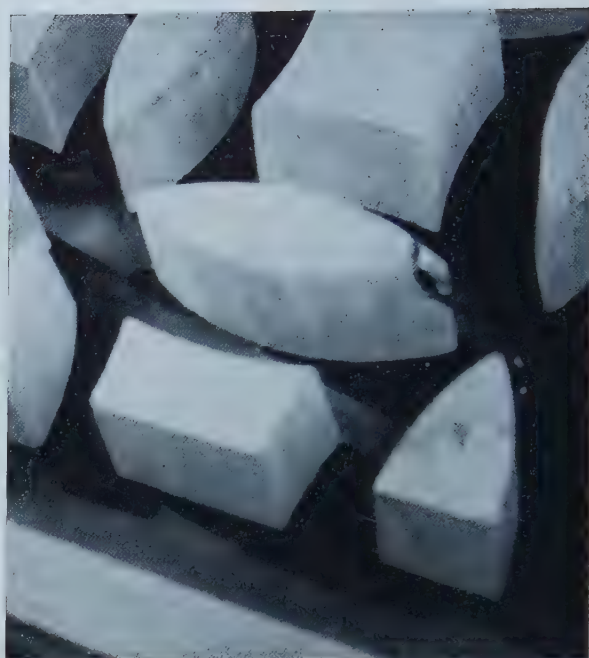
PLATE 3. HEAD OF SAINT FRANCIS, DETAIL FROM A FULL LENGTH FIGURE, CARVED IN GREEN CONCRETE BY M. SARREBEZOLLES, CHURCH OF SAINT LOUIS, VILLEMOMBLE, FRANCE. THIS HEAD IS THREE FEET IN HEIGHT, THE ENTIRE FIGURE ABOUT THIRTY FEET

PLATES 1 AND 2. (LEFT) EXTERIOR DETAIL AND (RIGHT) GENERAL EXTERIOR OF THE FRAUENS-FRIEDENSKIRCHE, FRANKFURT A.M., GERMANY. THE ENTIRE GROUP IS CONSTRUCTED OF REINFORCED CONCRETE AND HOLLOW TILE WITH A FACING OF PRECAST UNITS. HANS HERKOMMER, ARCHITECT. THIS IS AN ADMIRABLE EXAMPLE OF THE PROPER USE OF PRECAST CONCRETE



PLATES 4 AND 5. CHURCH OF SAINT ANTHONY, KALENTAL, NEAR STUTTGART, GERMANY. A FINE YET INEXPENSIVE TREATMENT IN FERRO-CONCRETE AND CINDER-CONCRETE BLOCKS, FINISHED IN PLASTER INSIDE AND OUT. HANS HERKOMMER, ARCHITECT

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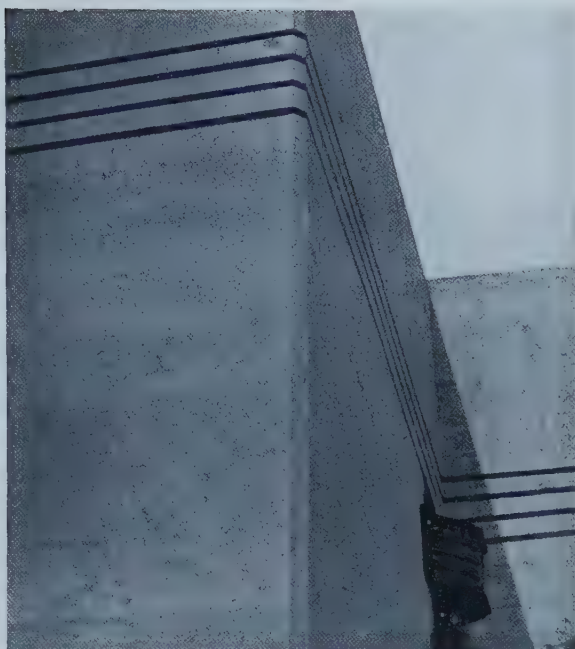
PLATES 6 AND 7. (LEFT) PART OF A WOODEN FORM CONTAINING PLASTER MOLDS (SHOWN IN DETAIL AT RIGHT) WHICH UNITE TO FORM A PATTERN IN A PRECAST BALUSTRADE UNIT



PLATE 8. WOOD WALL AND FLOOR FORMS. REINFORCING STEEL IS BEING SET IN PLACE PREPARATORY TO PLACING THE CONCRETE



PLATE 9. WALL FORMS. IN THE FOREGROUND IS A SMALL HAND MIXER FOR THE COMBINING OF DRY CEMENT AND PIGMENT



PLATES 10 AND 11. (LEFT) EXPOSED AGGREGATE WALL SURFACE WITH INSET PRECAST CONCRETE GRILLE. (RIGHT) SMOOTH WALL OBTAINED BY GRINDING WITH CARBORUNDUM DISCS

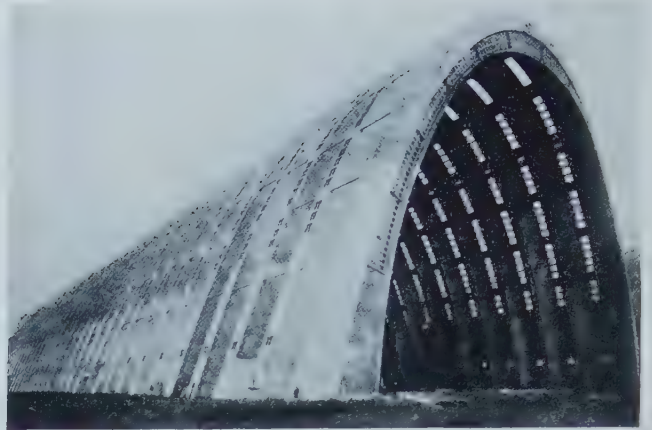


PLATE 12. COMBINATION OF SMOOTH SURFACE PRECAST DETAIL WITH EXPOSED AGGREGATE WALL

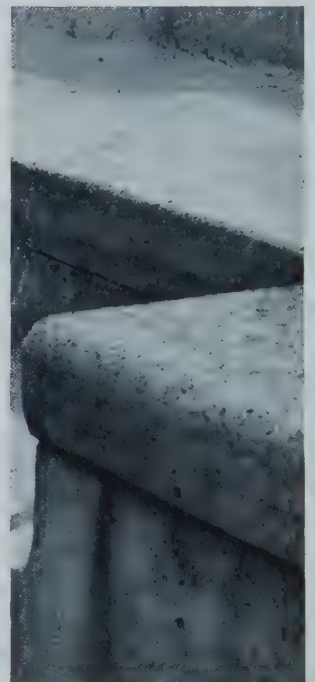


PLATE 13. DETAIL OF PRECAST BALUSTRADE SET AGAINST SMOOTH POURED CONCRETE PIER WITH RED PRECAST COPING

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PLATES 14 AND 15. (LEFT) DETAIL OF POURED CONCRETE HOUSE (SEE PRECEDING TWO PAGES FOR SURFACE DETAILS). (RIGHT) DIRIGIBLE HANGAR OF REINFORCED CONCRETE AT ORLY, FRANCE. THE STRUCTURE IS ABOUT ONE THOUSAND FEET LONG. INSIDE HEIGHT, ABOUT ONE HUNDRED FIFTY FEET; SPAN, ABOUT TWO HUNDRED AND TEN FEET



PLATES 16 AND 17. THE HARVARD STADIUM BUILT IN 1901 IS ONE OF AMERICA'S OLDEST SUCCESSFUL LARGE STRUCTURES PRINCIPALLY OF REINFORCED CONCRETE. (RIGHT) DETAIL OF SURFACE OF SEATS SHOWING CONDITION AFTER THIRTY-TWO YEARS OF WEATHERING

FERRO-CONCRETE is thus a material of unrivalled architectural possibilities and beauty, which may truly be said to form the basic anatomy of an architecture, for it not only can form the bones and muscles of a structure, but also its enveloping surfaces; and on account of its monolithic character it achieves a unity not possible in any other building material. On account of its plasticity it may be molded into any form or design, which, together with its color, may be knit into the very fibre of the structure. If we will use for concrete the same understanding and skill which is devoted to other building materials, an architecture of permanence and beauty will result, eminently suited to the building methods of to-day and to the carrying on of the building traditions of the Church.

Reinforced Concrete as an Architectural and Structural Material

L. W. WEED

DESPITE its unlimited and yet economical possibilities, both architectural and structural, the use of reinforced concrete in the United States has been regrettably confined to industrial and commercial buildings. For a fine appreciation of the great strength and high artistry attainable in concrete, one need only view such structures as Saint Joseph's Church in Seattle, the Norton Memorial Hall in Chautauqua, New York, the Life Science Building of the University of California, or the Manoir Richelieu Hotel at Murray Bay, Province of Quebec, to name only a few of the hundreds of classic examples of reinforced concrete in non-commercial buildings.

It is quite probable that the restricted application of reinforced concrete in construction, where architectural beauty is desirable, may be due to a general lack of knowledge of its properties and possibilities. The purpose here is to discuss briefly those characteristics which enable the designer to use concrete intelligently.

The three general and most important characteristics are: appearance of surface, durability, and strength. The first is discussed in an article by John Walter Wood appearing in this issue and will not be dealt with here.

Durability and strength are closely related. Sixteen years of extensive experimentation and application have demonstrated that both are primarily governed by the water-cement ratio for workable or plastic concrete mixtures. The conception of concrete based upon the water-cement ratio is that concrete is a mixture of inert materials called aggregate — such as sand, gravel, or crushed stone — with the voids filled and each particle of aggregate coated with a portland cement paste, the cement paste being a mixture of portland cement and water.

Every one knows that water is essential in the making of concrete. What every one does not know is that the quantity of water is a highly important factor in determining the strength of the resultant concrete. Research has indisputably developed that the minimum of water that can be used to make a concrete mixture workable will insure the maximum of ultimate strength. The average layman — and many builders for that matter — are prone to add water with a generous hand to their concrete mixes because it makes them easier to work with. What they do not appreciate is that strength is decreased as water is increased. Prodigious strength could be obtained if concrete could be made with an irreducible minimum of water at the time of mixing. Such a minimum of water, however, would result in a mixture that would be an unwieldy mass.

The importance of applying the water-cement ratio in making concrete may be explained in this manner. After an interval of time, when hydration has taken place, there is no longer existent in concrete the water that was used to make it a workable mixture at the time of building. Yet nothing takes the place of the water that did not actually enter into chemical union with the cement. So, it follows that there must be voids, or empty spaces, from which the surplus water has evaporated and which obviously add nothing to strength.

The strength of the paste, therefore, depends upon the amount of water added to the cement. The quality of the concrete itself depends upon the strength of paste, which in turn depends upon the amount of water added to the cement. In short, to secure a concrete of a predetermined quality involves selecting the proper water-cement ratio either for the structural strength desired, or for the conditions of use or exposure; whichever is more severe. When this proper water-cement ratio has been selected, the paste is made and the fine and coarse aggregate added to it to obtain concrete of the proper workability required for the conditions under which it is to be placed.

For reinforced concrete structures, the structural designer can select the strength of concrete suitable and economical for the particular structure and proceed with his structural design in accordance with established coefficients. In selecting a structural type of design, the advantages of reinforced concrete are often overlooked. With the use of a water-control concrete, there is no necessity of limiting the concrete to a strength of 2000 pounds per square inch. Concretes from 2000 pounds per square inch to 3500 pounds per square inch have been successfully used in large engineering structures, which shows that predetermining the strength of concrete can be worked out successfully in practice. With the advantage of higher strength concrete and the flexibility in the shape and size of structural members inherent in reinforced concrete, it can be economically used in practically all types of structures. And resulting structures will be highly fire-safe and require minimum upkeep.

The use of reinforced concrete in architecture for exteriors and interiors of buildings involves the appearance of the exposed surface and its durability. The primary requisite of a durable concrete is water-tightness. This also depends upon the water-cement ratio. Another factor which must be considered is the proper hydration of the cement. This requires time and proper temperatures. In order to secure plastic mixtures more water is used than is required for the complete hydration of the cement. As has been pointed out, this surplus eventually dries out, leaving voids. Thus the use of too much water contributes in two ways to detract from the water-tightness and durability of the concrete, by weakening the cement paste and by excess voids in the concrete.

To secure a higher strength and a more durable concrete, all the water used should be retained for as long a time as practical in order to produce the most complete possible hydration.

The first problem to be solved, therefore, is the selection of a proper water-cement ratio. Based upon experimental data and field examinations of structures in service, it has been possible to establish certain limits which will insure durable structures if used with good materials, thorough mixing, and careful handling and placing. See Table I. As a guide to proportions required for these water-cement ratios, see Table II.

Monolithic walls that enclose a building must be constructed of concrete of such quality as will resist the destructive agencies of seasonal change. Referring to Table I will enable the user to select such a concrete. The aggregate must be non-porous and durable. The proportions of aggregate should be such as to give smooth and easily workable concrete. The exact amount of each aggregate required will depend to a large extent on the size and grading. Generally, the volume of fine aggregate should be about two-thirds that of the coarse aggregate. This gives a slightly over-sanded mix and a concrete that will place easily and produce a smooth surface. By specifying the

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exact amount of mixing water and allowing the contractor to work out the best mix, the architect may be assured of concrete of the desired quality.

TABLE I. RECOMMENDED WATER-CEMENT RATIOS FOR CONCRETE TO MEET DIFFERENT DEGREES OF EXPOSURE

These requirements are predicated on the use of concrete mixtures in which the cement meets the present standard specifications of the A. S. T. M. and to which an early curing is given that will be equivalent to that obtained when protected from the loss of moisture for at least 10 days at a temperature of 70 deg. F. For curing conditions less favorable than this, correspondingly lower water-cement ratios should be used. The values are also based on the assumption that the concrete is of such consistency and is so placed that the space between the aggregate particles is completely filled with cement paste of the given water ratio.

Exposure	Class of structure	Water-cement ratio, U. S. gal. per sack ¹		
		Reinforced piles, thin walls, light structural members, exterior columns and beams in buildings	Reinforced reservoirs, water tanks, pressure pipes, sewers, canal linings, dams of thin sections	Heavy walls, piers, foundations, dams of heavy sections
Extreme: 1. In severe climates like the northern U. S., exposure to alternate wetting and drying, freezing and thawing, as at the water line in hydraulic structures. 2. Exposure to sea and strong sulphate waters in both severe and moderate climates.		5½	5½	6
Severe: 3. In severe climates like the northern U. S., exposure to rain and snow, and freezing and thawing, but not continuously in contact with water. 4. In moderate climates like southern U. S., exposure to alternate wetting and drying, as at water line in hydraulic structures.		6	6	6¾
Moderate: 5. In climates like southern U. S., exposure to ordinary weather, but not continuously in contact with water. 6. Concrete completely submerged, but protected from freezing.		6¾	6	7½
Protected: 7. Ordinary inclosed structural members; concrete below the ground and not subject to action of corrosive groundwaters or freezing and thawing.		7½	6	8¾

¹ Surface water or moisture carried by the aggregate must be included as part of the mixing water.

Courtesy Portland Cement Association

The amount and proportions of aggregates should be adjusted so that, at all times, a plastic mix is obtained that will go into all angles of the forms without requiring an excessive amount of spading. The mix should not be so wet that water will accumulate on the top of a layer of concrete as it hardens. All of the materials must be carefully measured so that the density of the resulting wall will be uniform.

Another factor that is of great assistance in the production of water-tight and durable concrete is its proper curing. Whenever possible, concrete should be kept damp

TABLE II. TRIAL MIXTURES FOR VARIOUS WATER-CEMENT RATIOS		
Water-cement ratios indicated include moisture contained in the aggregate. Proportions are given by <i>volume, aggregate dry and compact</i>. Thus 1-2-3½ indicates 1 volume of cement, 2 volumes of sand, and 3½ volumes of coarse aggregate. If the aggregates are to be measured in the <i>damp</i> and <i>loose</i> condition they will occupy greater volume than when dry and compact. Amount should be determined by test. Approximate average value for sand 20 per cent, for coarse aggregate 6 per cent. For approximate proportions <i>by weight</i> add 15 per cent to proportions of aggregate shown in the table. The mixes are given as a <i>guide only</i>. The first batch should be made with measured water content and the proportions thereafter adjusted to give the desired workability, maintaining the specified water-cement ratio.		
Slump Inches	Trial Mix, Dry Compact Volumes for Maximum Size of Aggregate Indicated	
	1 inch	2 inches
Water-Cement Ratio 5½ Gallons per Sack		
½-1 3-4 5-7	1-2-3 1-1¾-2½ 1-1½-2	1-2-3½ 1-1¾-3 1-1½-2½
Water-Cement Ratio 6 Gallons per Sack		
½-1 3-4 5-7	1-2¼-3¼ 1-2-3 1-1¾-2½	1-2¼-4 1-2-3½ 1-1¾-3
Water-Cement Ratio 6¾ Gallons per Sack		
½-1 3-4 5-7	1-2½-3½ 1-2¼-3¼ 1-2-3	1-2½-4 1-2¼-3¾ 1-2-3½
Water-Cement Ratio 7½ Gallons per Sack		
½-1 3-4 5-7	1-3-4 1-2½-3¾ 1-2¼-3½	1-3-4¾ 1-2½-4¼ 1-2¼-3¾

Courtesy Portland Cement Association

for a period of ten days or more after it has hardened. Leaving the forms in place helps to prevent the rapid evaporation of moisture from the surface of the concrete. Sprinkling and covering with burlap, canvas, or other suitable materials that can be kept damp assists in retaining moisture in the concrete.

It is important that the concrete be evenly distributed along the forms and not allowed to flow by gravity from point of discharge to any point in the wall. The forms should be filled evenly and, where possible, in one continuous operation. Any breaks or joints in the placing of the concrete should be made on well defined lines previously determined by the architect. In some cases it may be advisable to have all fill planes at the floor level, while in others at the bottom of the window openings.

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Exterior walls must be properly reinforced. For walls six inches thick, the minimum horizontal reinforcing should be half-inch round rods twelve inches on centre in the centre of the wall. For walls eight inches thick, half-inch round rods twelve inches on centre near each face should be used as a minimum. Additional five-eighths inch round rods should be used on all sides of window and door openings extending at least thirty inches beyond the edges of the openings. Proportional amounts of reinforcing should be used in thicker walls. The reinforcing should be protected by at least one and one-half inches of concrete.

No attempt has been made in this article to write detailed specifications or to give detailed design information. The methods of securing a concrete of uniform and predetermined quality have been described and recommendations made to guide the selection of the proper quality of concrete for any structure.

The Use of Concrete in Ecclesiastical Building

FREDERICK VERNON MURPHY

SYNTHETIC building materials will undoubtedly find their place in ecclesiastical structures. Provided that these materials are introduced to give dignity, durability, and aesthetic interest, there is no logic in their elimination upon either artistic or structural grounds.

Concrete is one of the oldest of such materials and its making has been fairly well understood for ages. It is unfortunate that in recent years it has been brought into competition with stone and has been treated in imitation of it. It has also suffered in being made to vie with mosaic.

Ecclesiastic architecture, above all other forms, must deal with integrity, and sham has no place in it. Concrete has much to recommend it: economy of installation, great strength when properly designed, and certain fine possibilities in color and texture. Its surface color may be controlled to a remarkable degree, and its texture is likewise susceptible to a wide variation.

Modern European design in concrete has set us thinking more intensely as to its future uses. Such churches as the relatively small edifices at Elizabethville near Paris and the Church of Saint George at Stuttgart indicate very clearly the latitude permissible and its intrinsic merits as well as its limitations. In the first named, concrete is made to submit to carving, while still wet. In the latter, the decorative sculpture is frankly in stone, and honest brickwork veneers the exteriors of the walls. Notre Dame du Raincy indicates the greatest economy possible through the repeated use of the same forms. Unless we really need to economize, there is no reason to make the House of God less attractive than our means afford; but in rural communities where expense must be saved, every saving device is valuable.

I have used concrete, treated with surfaces decorative in character, in several Churches: the Shrine of the Sacred Heart in Washington, D. C., Saint Francis de Sales in Buffalo, and Saint Mary's in Mobile, in each instance endeavoring to give fresh thought to the enterprise. Each effort has produced happy coincidences of color harmonies, or pleasing textural relationships stimulating to further study. The artistic formula, an ever-changing one, delights in restoring one to principle, and one is brought back to the contemplation of form, color, light and shade, scale, surface interest: the background of all plastic design. In my humble opinion there is a vast field to be explored in concrete design for ecclesiastic buildings. Those collaborators with the architect, the engineer, the chemist, the decorator, the skilled craftsman, working upon their thesis — the Church — in the intimate coördination of their efforts will undoubtedly produce something fine, secure in necessary tradition and pleasing to the critical judgment.

The Renaissance and Christian Art

C. R. MOREY

THE RENAISSANCE presents a different aspect each time that definition of it shifts its angle of approach. To some it is the resurrection of antiquity, the "revival of learning"; to others the advent of humanism, the reassertion, as opposed to the humble concept thereof conveyed by mediaeval teaching, of individual importance. In both of these conceptions, the Renaissance is something new, something that arose in Italy, something that originated in the late fourteenth and early fifteenth centuries.

The historian of Christian art would nevertheless insist that what was new in the Renaissance was not invented till the sixteenth century. The naturalism of the fourteenth and fifteenth centuries is to him quite as Gothic a phenomenon as the cathedral art of the thirteenth — even more so, since its revelation of the absorbing beauty and interest of man's environment, and its analysis of individual character in man himself, is only the emancipation of the innate realism of Gothic art, which had been till the fourteenth century controlled by the symbolic synthesis of scholasticism. The mediaeval church had transformed Gothic delight in nature into love of God, but when this focal tension was relaxed, it was not surprising that nature became as fascinating as its Creator. And if one seeks to identify specifically the spot in Europe where this expansion of Gothic realism began, priority is to be assigned not to Italy, but rather to North France and Flanders, always the breeding-ground of mediaeval change. Transferred to Italy, the realistic movement took on more striking aspect in the very degree to which the freer personality of the Italian artist could detach itself from the collective tradition of the Middle Ages — and also took on more loveliness, by virtue of Florentine grace and sensibility to form. The Italian also awakened sooner to the beauty of antique architecture and sculpture, but only to grace therewith the realistic world that the North had discovered before him. Italian art of the fifteenth century is still at core as Gothic as that across the Alps, however much of its outward aspect and embroidery may be reminiscent of antiquity. Like the *palazzi* of its architects, the façade delightfully translates the Roman into local dialect, but the building stands by virtue of the Gothic vaulting within.

The fifteenth century is thus the flowering of that realism which was the vital element in Gothic art. Its interest in humanity is part and parcel of the fresh enjoyment of a material world, whose beauty must no longer be viewed as either meretricious or symbolic. The very wonder with which the early humanists received the revelation of ancient love, the romance that surrounded their search for manuscripts, the Christian virtue which they ascribed to antique philosophizing — all this bespeaks the continuing humility of the mediaeval mind. But mediaeval above all is the catholicity of both the art and scholarship of the Quattrocento; from the wealth which antiquity unfolded and from the entrancing variety of the material world, there was no attempt to select the beautiful and perfect as distinguished from the merely interesting. Scholars delighted in anything they could dig up of ancient literature, and had not yet become the pedantic critics of Latin texts and style which they were in the succeeding centuries; in painting and relief, the classic reminiscence is part of an indiscriminate accumulation of detail — a welcome addition to the minutiae of back-



PLATE III. ANDREA DEL SARTO; MADONNA OF THE HARPIES



PLATE I. FILIPPO LIPPI; CORONATION OF THE VIRGIN, CENTRAL PORTION



PLATE II. J. SANSOVINO; BACCHUS



PLATE VIII. GIRARDON; RAPE OF PROSERPINE



PLATE V. MICHELANGELO; BOUND SLAVE



PLATE VI. BERNINI; ECSTASY
OF SAINT FRANCIS



PLATE IX. PEDRO DE MENA;
SAINT FRANCIS

PLATE IV. FEMALE SAINT;
PRINCETON ART MUSEUM





PLATE VII. ROME; CHURCH OF THE JESÙ, INTERIOR

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ALTAR WITH TEXTILE APPURTENANCES SHOWN IN THE SMALL CHURCH EXHIBITION OF THE LITURGICAL ARTS SOCIETY HELD THIS SPRING IN NEW YORK. OVER 2000 PERSONS ATTENDED THIS EXHIBITION

grounds and interiors and to the *genre* by-play which has so dispersive an effect upon Quattrocento composition and testifies to the unselective curiosity of the age.

The pictures of Filippo Lippi (Plate I) are perhaps as good examples as one can find in Italy of such wholesale recapturing of nature. The same absorption in the physical world, to the prejudice of religious content, can be found across the Alps in the painting of the Van Eycks (Frontispiece) and their followers, the difference being that the northerner is mainly entranced by his physical environment, the Italian by human grace and charm. But neither is consciously forsaking the ways of his mediaeval forbears; the naturalism of both has no conscious intent beyond the service of the Church. These painters of the fifteenth century were painting in normal fashion, i.e., seeking to portray experience as they and their epoch understood it, and if they, with no un-Christian purpose, made man and his surroundings more interesting than God, they were no less thereby the true exponents of their time.

BUT the sixteenth century presents us with a new repertory, filled with the personnel and paraphernalia of antique mythology. The Italian Quattrocento, which delighted in Roman ornament and *putti* to relieve the homeliness of its faithful rendition of Quattrocento life and dressed its gods and goddesses in contemporary clothes, was followed by an age which could and did evoke antiquity with archaeological exactitude. Sansovino's Bacchus (Plate II) might pass for a real antique. Indeed one feels the Olympian presence even in the Christian subjects of the sixteenth century, and divines an Apollo tortured by the arrows of Saint Sebastian, a Juno enthroned in the Madonna's place (Plate III).

These Italian sculptors and painters, or the patrons for whom they worked, had not of a sudden become Greeks and ancient Romans. But there had come about a curious revolution in artistic thinking and practice, the counterpart of similar thinking and doing in the fields of politics and religion. This revolution may be described as the emergence of the academic point of view, or, perhaps more effectively, as the divorce of beauty from truth. It resulted at any rate in the notion of an absolute standard of perfection, achieved merely by taking thought, and without necessary relation to past or present experience. This is the new thing presented by the Renaissance to the western world, which has never since ceased to labor with the difficulty of relating the resultant ideal of unity — submission of parts to the whole, conformity to type — to its traditional Gothic and realistic habit of particularity and diversity. The Quattrocento had discovered and employed the antique as a picturesque embroidery; the Cinquecento enthroned its forms and style as an infallible norm which human behavior must be made to fit. The early humanism had recognized in ancient literature and art no more than a sympathetic expression of its recovered sense of human dignity; the Cinquecento saw in the antique a perfection which could be regained by mere exercise of logic and convenient ignoring of contemporary fact and past tradition.

The political applications of this academic way of achieving order are evident through the sixteenth and seventeenth centuries, most conspicuously in the arbitrary partition of Italy by Charles V in 1530, and in the centralization of France under the Bourbons, when city charters, feudal rights, and the privileges of guilds were submerged in the quest for unity and uniformity. The Council of Trent, in its effort to purge the mediaeval church of its abuses, pursued the same ideal of *a priori* perfection, and, in its effort to eradicate the mediaeval weeds, killed many a tradition that was

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healthily rooted in local practice. There is no doubt that the religious conflict helped along the academic point of view in both the Protestant and Catholic camps; both sides were conscious, if Europe was not to fall into religious chaos, of the necessity of uniformity of belief; and on both sides this zeal for unity outran its objective. The excesses of the Inquisition and the Index were of wider effect but of no different quality from Calvin's tyranny at Geneva.

One single obscure effort was made by Gothic style to embody the new desideratum of order and unity in its own language. French writers call it the *Détente*; its examples are few, and were executed in the centre and east of France in the early sixteenth century. One of these is the female saint (Plate IV) in the Princeton Museum, a statue that has all the feminine nobility which a Greek presentment could give, and is classic also in its self-completeness. But it is also Gothic in every affectionately handled detail, and realistic in the best and ultimate sense because it reveals through its lovely homeliness the fundamentals of human character and emotion.

The uniform pathos which the sculpture of the *Détente* exhibits is suited to the melancholy passing of Gothic tradition in Christian art which was witnessed in the sixteenth century. The same tragedy, at the same time, was enacted in the work of Michelangelo, a truly religious soul, who by sheer genius forced the dying Gothic content through the medium of classic form. His powerful, inhibited figures reflect the disparity between Christian emotion and the antique ideal (Plate V), between free human will and the Will of God. The rational forms of classic sculpture were not made for the ecstasy of a Christian mystic; they writhe in the possession of an unfamiliar spirit, and betray by brutal distortion, incongruous proportions, and discordant composition the force of the collision of mediaeval Christianity with the Renaissance.

THE problem that tortured Michelangelo's genius, with results of tragic beauty, was solved by the Baroque, albeit by removing the factor therein of the individual soul. A style of Italian origin, but of European range, the Baroque reflects that aristocratic internationalism which spread over Europe in the seventeenth century, as the ruling classes divorced themselves from contact with the people, convinced themselves at length that they alone constituted society, and felt in consequence their membership in an international polity. The old Gothic attachment to local and individual peculiarity, the rooting of religion in personal experience, the consequent sincerity which still survives all classic training in the work of Michelangelo, were obstacles to formal grace and elegance which the Baroque ignored.

In the fifteenth century, composition was still Gothic in its promiscuity; the sixteenth was in nothing so classic as in its insistence on the architectonic building-up of its ensembles, with a dominant central focus which restored to composition the long-lost Hellenic triangle. The Baroque, however, tended rather toward a diagonal axis, seeking the soaring and disappearing effect of flame (Plate VI). W. F. Stohlman, in his lectures on Renaissance and modern sculpture, defines the effect of Baroque as "the movement of mass *in space*." The last phrase is essential to the definition, since otherwise the Christian art of the seventeenth century, in its essential of unifying movement, would coincide with that produced by the second school of Pergamon, and represented by the frieze of the Great Altar at Berlin, and the Laocoön of the Vatican. The difference lies in the self-containedness of the Hellenistic figures; any one of the gods or giants of the Pergamene frieze makes a satisfactory composition in itself, since

its movement, however violent, returns upon itself by *contrapposto*. Baroque figures on the other hand court the space about them, reach out to it like licking tongues of fire, and soar within it (Plate VI). Baroque churches, however much they follow classic rules in orders, domes, and centralized plan, nevertheless contrive to expand the limited interior of the Pantheon into spatial suggestion of unlimited extent (Plate VII). This suggestion, the introduction into ideal concepts of the notion of infinitude, is, as was pointed out in what was said of Gothic style, an element of aesthetic effect entirely un-classic, but thoroughly Gothic and Christian. Thus was the Baroque enabled, like Michelangelo, to bend the Hellenic vocabulary of academic art to Christian expression, disturbing by movement its classic calm, merging the feeling thereby generated in a space charged with the Divine Presence, illimitable and undefined.

But unlike those of Michelangelo's art, Baroque effects are not poignant; the fervor which inspires its tumultuous movement is sincere enough, but it is not the fervor of the individual soul. The Baroque is an art of a Papacy without local attachment, whose territory was the world; it is the expression of the international Society of Jesus, an art of kings by divine but not popular right — the first style, in fact, in the history of art to which no local or racial adjective can be fittingly attached. It is also an art, for all its emotional volume, whose genesis is academic and intellectual; its far-flung compositions, the spacious vistas of its interiors, the apparent freedom of movement in its figures and architectural forms, are in the last analysis as carefully controlled and planned for decorative propriety as any ensemble of the sixteenth century.

It follows that Baroque achievement, lacking concrete focus, is more original and valid in the abstract media of architecture and music than in the arts that reproduce nature. The interiors of Jesuit churches revive the infinitudes of the cathedral, though with disciplined and academic elegance. In music the Baroque period was creative enough to produce a new form — the opera — yet here again an ultimate academic inspiration can be divined in the assumption that dramatic action is capable of reduction to rhythm.

NEVERTHELESS it was not the Baroque, but its French counterpart in the Bourbon seventeenth century, that established in Europe and handed on to our own times the academic point of view. The Bourbon method of transforming France, Gothically diverse in the political and religious sense, into the marvellously homogeneous nation that we know to-day, was not a frontal attack upon the mediaeval institutions, but an undermining competition. Thus the military establishments of feudalism faded away as their uselessness was demonstrated by the new institution of the standing army; free thought and expression at the University dwindled in view of the new prosperity of the royal Collège de France. So also the guilds, which maintained the Gothic tradition of native French art, deprived of royal and aristocratic patronage by the establishment of the academy of painting and sculpture, disappear after the seventeenth century.

Following royal and aristocratic taste, the Academy and its branch in Rome, which it founded as a training school for young French architects, painters, and sculptors, had nothing but contempt for native style. The Bourbon state, as organized by Richelieu and Mazarin, needed for its success just those principles of abstract logic and centripetal unity which were the outward aspects, but not the inner well-spring, of Hellenic culture. The last Valois kings of the sixteenth century had already accustomed the ruling class in France to classicism as interpreted by the Italian Renaissance,

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though with an admixture of traditional style which resulted in the charming synthesis of native and antique which one admires in the châteaux of Francis I and Henry II, and the painting and sculpture of Fontainebleau. But with the development of the Bourbon régime there came a more knowing application of Vitruvian rules and a closer imitation of Roman marbles, which make the seventeenth century resemble in its archaeological correctness the Italian Cinquecento. The playwrights of the time are perhaps the best exponents of such neo-classicism in the pains they took to fit romantic action and personality into the unities and types of Greek drama. The movement and *brio* of the Baroque, and above all its reintroduction in academic guise of Gothic space, were thus reduced or excluded from Bourbon official art by the rigidity of academic rules. The single Baroque sculptor in France in the seventeenth century was Pierre Puget, and he had small success at Versailles. Baroque architecture was largely confined to the churches of the French Jesuits, which themselves are commonly more sober in effect than their sister churches in Italy.

THE Baroque of Italy is better termed an official and ecclesiastic art than a Christian; of the style of Versailles, even when it turns to Christian subjects, it is hard to use the word "Christian" at all, so deeply are the artists steeped in pagan lore and pagan style (Plate VIII). The same applies to the adaptations elsewhere in Europe of both Baroque and the French Academic: in Germany, the Low Countries, and England. Quite different is the "Baroque" of Spain. Here is seen for one thing a continuation even into the seventeenth century of mediaeval native woodcarving, accentuated and realistic polychroming, and Gothic multitudinous detail. Nor do the sculpture and painting of Spanish churches, for all their adopted Italian classicism, ever follow Italy into the generalization of the grand style, nor France into barren academicism. The content of the Spanish Baroque is concretely and poignantly sincere, as might be expected from a race whose Christianity, even to the eve of the sixteenth century, was a militant faith, crusading against an infidel frontier. The seriousness and surviving realism of the Spanish art of the Renaissance are evident in an outstanding quality that distinguishes it from the Renaissance in France and Italy: the Spaniard never shrinks from *gaucherie*, or a sacrifice of formal beauty, to clarify and enforce a Christian theme.

In Pedro de Mena's "Saint Francis" (Plate IX) one might say that the Christian art of Europe came to an end. Here, in this singularly modern-looking figure, there is still pure Christian content, and a technique whose sophistication does not mask its Gothic derivation. But although, since the Baroque period, there have been countless churches built, and statues carved and pictures painted for their adornment, the architecture, sculpture, and painting which have been thus employed were not Christian in origin or *raison d'être*. The academic point of view demoted the intuitive and instinctive in art, whereby in the middle ages Christianity's grand theme had found naïve but real expression, and established in its stead the principle of beauty achieved by theory and rules, capable of transmission by pedagogy, and subservient to the absolute and exotic standard of classical antiquity. Thus was artistic perfection divorced from experience, religious or otherwise, and reduced in scale to the intellectual possibilities of its creator. The academic styles that have succeeded each other since the seventeenth century, as a consequence of this curious divorce of beauty from truth, can hardly be classified as Christian art, since they recognize no inspiration higher than the human mind.



AUGUSTUS WELBY NORTHMORE PUGIN

(Aetatis suae circa 30)

ARTIST UNKNOWN

Courtesy of the National Portrait Gallery